NASA Procedural Requirements

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CHAPTER 4. Program and Project Requirements by Phase

4.1 Programs -- Formulation Phase

4.1.1 **Purpose:** The purpose of program formulation activities is to establish a cost-effective program that is demonstrably capable of meeting Agency and Mission Directorate goals and objectives. The program Formulation Authorization Document (FAD) authorizes a Program Manager to initiate the planning of a new program and to perform the analyses required to formulate a sound Program Plan. Major reviews leading to approval at KDP I are the Acquisition Strategy Meeting (ASM), the Program/System Requirements Review (P/SRR), the Program/System Definition Review (P/SDR)/ Program Approval Review (PAR), and the governing PMC review. In addition, at the discretion of the DA, a Preliminary Program Approval Review (PPAR) leading up to a KDP 0 may be required to ensure major issues are understood and resolved prior to KDP I. A summary of the required gate products is provided in Table 4-1.

4.1.2 **Requirements:** During program formulation, the Program Manager and the program team; shall:

a. For all *programs*-

(1) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership commitments and obtain the ASM minutes.

(2) Support the MDAA in developing and obtaining approval of the FAD, PCA, and appropriate annual budget submissions.

(3) Prepare and obtain approval of the Program Plan that follows the template in Appendix E. (See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.)

(4) Support the MDAA and the NASA HQ Office of External Relations in obtaining approved interagency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation; in reviews, integration and test, and risk management).

(5) Document the traceability of program requirements on individual projects to Agency needs, goals, and objectives, as described in the NASA Strategic Plan.

(6) Initiate the development of technologies that cut across multiple projects within the program.

(7) Prior to the program life-cycle formulation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(8) Plan, prepare for, and support the program life-cycle formulation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(9) If required by the DA, obtain KDP 0 readiness products as shown in Table 4-1.

(10) If required by the DA, plan, prepare for, and support the governing PMC review prior to KDP 0.

(11) Obtain KDP I readiness products as shown in Table 4-1.

12) Plan, prepare for, and support the governing PMC review prior to KDP I.

b. For *single-project* and *tightly coupled programs* - implement the requirements in paragraphs 4.3.2 and 4.4.2 (Pre-Phase A and Phase A) with the following stipulations:

(1) In *single-project programs*, the Project Plan may serve as the Program Plan, and KDP 0 (if required by the DA) and KDP I serve in lieu of KDP A and KDP B, respectively. In keeping with this, single-project programs are approved for implementation at KDP II. (At the discretion of the MDAA, there may also be a Project Plan separate from the Program Plan. In either case, all content required in Program and Project Plan templates must be included.)

(2) *In tightly coupled programs*, separate Project Plans are prepared for projects during their formulation. The Program Manager may allocate portions of the Program Plan to these individual Project Plans.

Products	Formulation		Implementation			
	KDP 0 (if required by the DA)	KDP I	KDP II	KDP III	KDP IV	KDP n
Program Products						
1. FAD	Baseline	Baseline				
2. PCA		Baseline	Update	Update	Update	Update
3. Program Plan	Preliminary	Baseline	Update	Update	Update	Update
4. Interagency & International Agreements		Baseline	Update	Update	Update	Update
5. Traceability of Program Requirements on Projects to the Agency Strategic Plan	Preliminary	Baseline	Update	Update	Update	Update
6. ASM minutes		Final				
KDP Readiness Products						
1. Standing Review Board Report	Final	Final	Final	Final	Final	Final
2. CMC Recommendation	Final	Final	Final	Final	Final	Final
3. Program Manager Recommendation (includes response to SRB Report)	Final	Final	Final	Final	Final	Final
4. MDPMC Recommendation	Final	Final	Final	Final	Final	Final
5. Governing PMC Recommendation	Final	Final	Final	Final	Final	Final

Table 4-1 Program Gate Products Maturity Matrix

NPR 7120.5D Program Plan - Control Plans	Formulation		Implementation			
	KDP 0 (if required by the DA)	KDP I	KDP II	KDP III	KDP IV	KDP n
1. Technical, Schedule, and Cost Control Plan		Preliminary	Baseline	Update	Update	Update
2. Safety and Mission Assurance Plan		Preliminary	Baseline	Update	Update	Update
3. Risk Management Plan		Preliminary	Baseline	Update	Update	Update
4. Acquistion Plan		Preliminary	Baseline	Update	Update	Update
5. Technology Development Plan		Preliminary	Baseline	Update	Update	Update
6. Systems Engineering Management Plan		Preliminary	Baseline	Update	Update	Update
7. Review Plan		Preliminary	Baseline	Update	Update	Update
8. Missions Operations Plan		Preliminary	Baseline	Update	Update	Update
9. Environmental Management Plan		Preliminary	Baseline	Update	Update	Update
10. Logistics Plan		Preliminary	Baseline	Update	Update	Update
11. Science Data Management Plan		Preliminary	Baseline	Update	Update	Update
12. Information and Configuration Management Plan		Preliminary	Baseline	Update	Update	Update
13. Security Plan		Preliminary	Baseline	Update	Update	Update
14. Export Control Plan		Preliminary	Baseline	Update	Update	Update
15. Education and Public Outreach Plan		Preliminary	Baseline	Update	Update	Update

Table 4-2 Program Plan Control Plan Maturity Matrix

4.2 Programs - Implementation Phase

4.2.1 **Purpose:** During implementation, the Program Manager works with the MDAA and the constituent projects to execute the

Program Plan in a cost-effective manner. Program reviews ensure that the program continues to contribute to Agency and Mission Directorate goals and objectives within funding constraints. A summary of the required gate products is provided in Table 4-1.

4.2.2 **Requirements:** During program implementation, the Program Manager and the program team shall:

a. For *all programs*-

(1) Execute the Program Plan.

(2) Support the MDAA in updating the PCA, as appropriate.

(3) Update the baseline Program Plan at KDP II and other KDPs, as appropriate. See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.

(4) Support the MDAA and the NASA HQ Office of External Relations in obtaining updated interagency and international agreements (including the planning and negotiation of updated agreements and recommendations on joint participation; in reviews, integration and test, and risk management).

(5) Conduct planning, program-level systems engineering, and integration, as appropriate, to support the MDAA in initiating the project selection process.

(6) Support the MDAA in the selection of projects, either assigned or through a competitive process.

(7) Approve project FADs and Project Plans.

(8) Prior to the program life-cycle implementation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(9) Plan, prepare for, and support the program life-cycle implementation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(10) Maintain programmatic and technical oversight of the projects within the program and report their status periodically.

(11) Review and approve annual project budget submission inputs and prepare annual program budget submissions.

(12) Continue to develop technologies that cut across multiple projects within the program.

(13) Obtain KDP readiness products as shown in Table 4-1.

(14) Conduct program-level completion activities for each project in accordance with the project life cycle for Phase F (see paragraph 4.9.2).

b. For *single-project programs* -

(1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B).

(2) For KDP III, implement the requirements of paragraph 4.6.2 (Phase C).

(3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D).

(4) For KDP V, implement the requirements of paragraph 4.8.2 (Phase E).

c. For *tightly coupled programs* -

(1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(2) For KDP III, implement the requirements in paragraph 4.6.2 (Phase C) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(4) For KDP V, implement the requirements of paragraph 4.8.2 (Phase E) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

4.3 Projects - Pre-Phase A

4.3.1 **Purpose:** During Pre-Phase A, a pre-project team studies a broad range of mission concepts that contribute to program and Mission Directorate goals and objectives. These advanced studies, along with interactions with customers and other potential stakeholders, help the team to identify promising mission concept(s) and draft project-level requirements. The team also identifies potential technology needs (based on the best mission concepts) and assesses the gaps between such needs and current and planned technology readiness levels. These activities are focused toward a Mission Concept Review and KDP A. A summary of the required gate products for this phase is provided in Table 4-3.

4.3.2 **Requirements:** During Pre-Phase A, the pre-project manager and team shall:

a. Support Headquarters- and program-related activities, in particular -

(1) Obtain an approved project FAD.

(2) Support the Program Manager and the MDAA in the development of the *draft* program requirements on the project.

b. Perform technical activities-

(1) Develop and document preliminary mission concept(s).

(2) Prior to the project independent life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(3) Plan, prepare for, and support the project independent life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities -

1) Develop and document a *draft* Integrated Baseline for all work to be performed by the project that includes the following:

(i) A high-level Work Breakdown Structure (WBS) consistent with the NASA standard space flight project WBS (Appendix G), a schedule, and a rough-order-of-magnitude cost estimate and cost range.

(ii) An assessment of potential technology needs versus current and planned technology readiness levels, as well as potential opportunities to use commercial, academic, and other government agency sources of technology.

(iii) An assessment of potential infrastructure and workforce needs versus current plans, as well as opportunities to use infrastructure and workforce in other government agencies, industry, academia, and international organizations.

(iv) Identification of potential partnerships.

(v) Identification of conceptual acquisition strategies for proposed major procurements.

d. Conduct KDP readiness activities - ;

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP A.

4.4 Projects - Phase A

4.4.1 **Purpose:** During Phase A, a project team is formed to fully develop a baseline mission concept and begin or assume responsibility for the development of needed technologies. This work, along with interactions with customers and other potential stakeholders, helps with the baselining of a mission concept and the program requirements on the project. These activities are focused toward System Requirements Review (SRR) and System Definition Review (SDR/PNAR) (or Mission Definition Review (MDR/PNAR)). The SRR and SDR/PNAR (or MDR/PNAR) process culminates in KDP B. A summary of the required gate products for this phase is provided in Table 4-3.

4.4.2 **Requirements:** During Phase A, the Project Manager and project team shall:[16]

a. Support Headquarters- and program-related activities-

(1) Support the Program Manager and the MDAA in the development of the baseline program requirements on the project.[17]

(2) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership agreements and obtain the ASM minutes.

(3) Support the Program Manager, the MDAA, and the NASA HQ Office of External Relations in initiating interagency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).

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[16] For projects that are initiated through a competitive Announcement of Opportunity (AO) or similar instrument, the Phase A time frame involves a great deal of project concept development, technology development, and independent assessment of PI-led teams that prepare detailed proposals aimed at meeting program-level requirements, all of which culminate in a rigorous selection process. As a result, the normal requirements for gate products and independent life-cycle reviews are waived, and the emphasis shifts to the gate products and independent life-cycle reviews at the end of Phase B.
[17] Program requirements on the project are contained in the Program Plan.

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b. Perform technical activities-

(1) Develop preliminary system-level (and lower-level, as needed) requirements.

(2) Develop and document a baseline mission concept (including key risk drivers and mitigation options and mission descope options).

(3) Develop a preliminary mission operations concept.

(4) Initiate technology developments, as required.

(5) Develop an initial orbital debris assessment in accordance with NASA Safety Standard 1740.14, *Guidelines and Assessment Procedures for Limiting Orbital Debris*.

(6) Prior to the project independent life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(7) Plan, prepare for, and support the project independent life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities-

(1) As early as practical, prepare and finalize Phase A work agreements.

(2) Prepare a *preliminary* Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.

(3) For contracts requiring Earned Value Management (EVM) (see Appendix F, paragraph 3.1.c(6)), conduct required Integrated Baseline Reviews (IBRs).

(4) For Category 1 and 2 projects, develop 60 days prior to KDP B a *preliminary* Cost Analysis Data Requirement (CADRe) that is based on the project's technical baseline/mission concept and consistent with the NASA Cost Estimating Handbook.[18] (Note: For competed projects, the requirement for a preliminary CADRe is met by the submission of a copy of the winning proposal and concept study report.)

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[18] The current version of the NASA Cost Estimating Handbook can be found at www.nasa.gov/offices/pae/organization/cost_analysi www.nasa.gov/offices/pae/organization/cost_analysis_division.html

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(5) Develop and document a *preliminary* Integrated Baseline for all work to be performed by the project, noting the following:

(i) The project's preliminary Integrated Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.

(ii) The project's preliminary Integrated Baseline includes a preliminary integrated master schedule, preliminary life-cycle cost estimate, workforce estimates, and the project's technical baseline/mission concept, all consistent with the program requirements levied on the project.

(iii) The preliminary life-cycle cost estimate is based on the project's technical baseline/mission concept and preliminary integrated master schedule.

(iv) The preliminary life-cycle cost estimate uses the latest available full-cost accounting initiative guidance and practices.

(v) The preliminary life-cycle cost estimate includes reserves, along with the level of confidence estimate provided by the reserves based on a cost-risk analysis.

(vi) The preliminary life-cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.

(6) Complete a *preliminary* business case analysis for infrastructure for each proposed project real property infrastructure investment consistent with NPD 8820.2,*Design and Construction of Facilities* and NPR 8820.2, *Facility Project Implementation Guide*, and for the acquisition of new aircraft consistent with NPR 7900.3, *NASA Aircraft Operations Management.*[19]

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[19] See the *NASA Business Case Guide for Facilities Projects* at http://www.hq.nasa.gov/office/codej/codejx/codejx.html

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(7) Work with the appropriate NASA Headquarters offices to initiate the development of MOUs/MOAs with external partners, as needed.

(8) Obtain a planetary protection certification for the mission (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.

(9) Develop a Nuclear Safety Launch Approval Plan (for missions with nuclear materials) in accordance with NPR 8715.3, *NASA General Safety Program Requirements*.

(10) Prepare and finalize work agreements for Phase B.

(11) Prepare for approval by the Program Manager a list of long-lead procurements that need to be procured in Phase B.

(12) In accordance with NPR 2190.1, *NASA Export Control Program*, support the appropriate NASA export control officials to identify and assess export-controlled technical data that potentially will be provided to foreign partners and the approval requirements for release of that data, all as a part of developing the project's Export Control Plan.

(13) In coordination with the OCFO, complete the Alternative Future Use Questionnaire (Form NF 1739), Section A, to determine the appropriate accounting treatment of capital assets. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities-

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP B. (Note: This does not apply to competed missions.)

4.5 Projects - Phase B

4.5.1 **Purpose:** During Phase B, the project team completes its preliminary design and technology development. These activities are focused toward completing the Project Plan and Preliminary Design Review (PDR)/Non-Advocate Review (NAR). The PDR/NAR process culminates in KDP C. A summary of the required gate products for this phase is provided in Table 4-3.

4.5.2 **Requirements:** During Phase B, the Project Manager and the project team shall:

a. Support Headquarters- and program-related activities-

(1) Obtain an update to the baseline program requirements on the project.

(2) Complete the environmental planning process as explained in NPR 8580.1, *Implementing the National Environmental Policy Act,* and *Executive Order 12114.* (Note: For certain projects utilizing nuclear power sources, completion of the environmental planning process can be extended, with the approval of the DA, into Phase C, but must be completed by the project CDR.)

(3) In coordination with the Program Manager, the MDAA, and the NASA HQ Office of External Relations, support the development of baseline external agreements, such as interagency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).

(4) Coordinate with the Space Operations Mission Directorate (SOMD) if the project involves space transportation services or launch services, in compliance with NPD 8610.7, *Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions*, and NPD 8610.12, *Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads*.

b. Perform technical activities-

(1) Implement the *preliminary* Project Plan.

(2) Baseline the system-level requirements and develop the subsystem and lower-level technical requirements leading to the PDR baseline.

(3) Develop a set of system and associated subsystem preliminary designs, including interface definitions, and document this work in a preliminary design report.

(4) As part of baselining the interface control documents, document compliance with NPD 8010.2, *Use of the SI (Metric) System of Measurement in NASA Programs*, and/or obtain any necessary waivers.

(5) Develop and document a baseline mission operations concept.

(6) Complete development of mission-critical or enabling technology, as needed, with demonstrated evidence of required technology qualification (i.e., component and/or breadboard validation in the relevant environment) or execute off-ramps (i.e., substitution of more mature or proven technologies) and document this work in a technology readiness assessment report.

(7) Plan and execute long-lead procurements in accordance with the Acquisition Plan. (Note: Long-lead procurements can only be initiated in Phase B when specifically approved by the MDAA.)

(8) Identify any risk drivers (and proposed mitigation plans for each risk).

(9) Develop a list of descope options.

(10) Develop a *preliminary* orbital debris assessment in accordance with NASA Safety Standard 1740.14.

(11) Develop and document a *preliminary* Missile System Pre-Launch Safety Package (MSPSP) in accordance with NASA-STD-8719.8, *Expendable Launch Vehicle Payload Safety Review Process Standard*, June 1998, and Air Force Space Command Manual 91-710, *Range Safety User Requirements*, Vol. 3. (Note: The latest release is dated July 1, 2004.)

(12) Prior to the project life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(13) Plan, prepare for, and support the project life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities -

(1) Complete and obtain approval of the Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.

(2) For contracts requiring Earned Value Management (EVM) (see Appendix F, paragraph 3.1.c(6)), conduct required Integrated Baseline Reviews (IBRs).

(3) For Category 1 and 2 projects, develop 60 days prior to KDP C a *baseline* CADRe that is based on the PDR-technical baseline and consistent with the NASA Cost Estimating Handbook.

(4) Prepare and finalize Phase C/D work agreements. (Note: Prior to approval to proceed, Phase C/D contracts' work scope and cost/price can be negotiated but not executed. Once the project has been approved and funding is available, the negotiated contracts can be executed, assuming nothing material has changed.)

(5) Develop, document, and maintain a project Integrated Baseline for all work performed by the project noting the following:

(i) The project's Integrated Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.

(ii) The project's Integrated Baseline includes the integrated master schedule, baseline life-cycle cost estimate, workforce estimates, and the PDR-technical baseline, all consistent with the program requirements levied on the project.

(iii) The baseline life-cycle cost estimate is based on the PDR-technical baseline and integrated master schedule and is expected to include a review of the entire scope of work with a series of in-depth assessments of selected critical work elements of the WBS prior to and following the project's PDR/NAR preceding KDP C. (Note: The CADRe is updated to reflect changes.)

(iv) The baseline life-cycle cost estimate uses the latest available full-cost accounting initiative guidance and practices.

(v) The baseline life-cycle cost estimate includes reserves, along with the level of confidence estimate provided by the reserves based on a cost-risk analysis.

(vi) The baseline life-cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.

(6) Reconcile (i.e., explain any significant differences) the project's baseline life-cycle cost estimate with the PDR/NAR Independent Cost Estimate.

(7) Complete a business case analysis for infrastructure for each of the project's proposed real property infrastructure investment consistent with NPD 8820.2, *Design and Construction of Facilities,* and NPR 8820.2, *Facility Project Implementation Guide*, and for the acquisition of new aircraft consistent with NPR 7900.3, *NASA Aircraft Operations Management.*[20] (Note: Business case analyses require the approval of the MDAA and the Assistant Administrator for Infrastructure and Administration, or designee.)

[20] See the *NASA Business Case Guide for Facilities Projects* at http://www.hq.nasa.gov/office/codej/codejx/codejx.html

(8) Develop a *baseline* planetary protection plan (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.

(9) Develop a *preliminary* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.

(10) In coordination with the OCFO, complete the Alternative Future Use Questionnaire (Form NF 1739), Section B, to identify the acquisition components of the project and to determine the appropriate accounting treatment of the capital acquisitions within the project. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities-

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP C.

4.6 Projects - Phase C

4.6.1 **Purpose:** During Phase C, the project completes the design that meets the detailed requirements and begins fabrication of test and flight article components, assemblies, and subsystems. These activities focus on preparing for the Critical Design Review (CDR) and the System Integration Review (SIR). This phase culminates in KDP D. A summary of the required gate products for this phase is provided in Table 4-3.

4.6.2 **Requirements:** During Phase C, the Project Manager and the project team shall:

a. Perform technical activities-

(1) Implement the *baseline* Project Plan.

(2) Complete all requisite flight and ground designs/analyses through their respective CDRs in accordance with NPR 7123.1 and document this work in detailed design report(s).

(3) Develop and test all requisite engineering models (brass boards, breadboards, full-up models) sufficiently prior to lower-level CDRs to enable test results to affect detailed designs.

(4) Develop requisite system and subsystem test beds needed for qualification and acceptance testing of flight articles.

(5) Following the appropriate lower-level CDR, initiate fabrication/procurement of flight article components, assemblies, and/or subsystems.

(6) Initiate the qualification and acceptance testing of flight article components, assemblies, and/or subsystems.

(7) Hold peer reviews, as appropriate, prior to major project reviews in accordance with the Project Review Plan.

(8) Develop a *baseline* orbital debris assessment prior to the project CDR in accordance with NASA Safety Standard 1740.14, *Guide Guidelines and Assessment Procedures for Limiting Orbital Debris*

(9) Develop a *preliminary* Operations Handbook that will be used to support the operations team.

(10) Develop and document a *baseline* Missile System Pre-Launch Safety Package (MSPSP) by the project-level CDR in accordance with NASA-STD-8719.8, *Expendable Launch Vehicle Payload Safety Review Process Standard*, June 1998, and Air Force Space Command Manual 91-710, *Range Safety User Requirements*, Vol. 3. (Note: The latest release is dated July 1, 2004.)

(11) Prior to the project independent life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(12) Plan, prepare for, and support the project independent life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(13) Following the SIR and/or PRR, (unless otherwise directed by the Program Manager) initiate system assembly and integration and test activities even if KDP D has not occurred.

b. Perform project planning, costing, and scheduling activities-

(1) For Category 1 and 2 projects, update the CADRe consistent with the NASA Cost Estimating Handbook following the project-level CDR.

(2) Update work agreements for Phase D.

(3) Maintain the Integrated Baseline under configuration management with traceability to the KDP C-approved baseline.

(4) Mature preliminary Project Plan Control Plans, as required by Table 4-4.

(5) Develop a *baseline* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.

(6) Develop a *preliminary* System Decommissioning/Disposal Plan.

c. Implement project cost and schedule control activities-

(1) Implement Earned Value Management (EVM) as documented in the Project Plan.

(2) For contracts requiring Earned Value Management (EVM) (see Appendix F, paragraph 3.1.c(6)), conduct required Integrated

Baseline Reviews (IBRs).

(3) Provide immediate written notice and a recovery plan to the Program Manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15% or more the KDP C-approved Integrated Baseline cost for Phases C through D. (Note: Since the Integrated Baseline cost contains project reserves, an EAC exceeding the Integrated Baseline cost presumes that these reserves will be exhausted.)

(4) Provide immediate written notice and a recovery plan to the Program Manager and the MDAA if a milestone listed for Phases C and D on the project life-cycle chart (Figure 2-4) is estimated to be delayed in excess of six months from the date scheduled in the KDP C-approved Integrated Baseline.

(5) If the trigger points in (3) or (4) above are breached and upon written notice from the Program Manager, update the Project Plan per direction received from the Program Manager.

d. Conduct KDP readiness activities-

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP D.

4.7 Projects - Phase D

4.7.1 **Purpose:** During Phase D, the project performs system assembly, integration, and test. These activities focus on preparing for the Flight Readiness Review (FRR). This phase culminates in KDP E. A summary of the required gate products for this phase is provided in Table 4-3.

4.7.2 **Requirements:** During Phase D, the Project Manager and the project team shall:

a. Perform technical activities-

(1) Implement the Project Plan.

(2) Initiate system assembly, integration, and test.

(3) As required by NPR 7123.1, execute and document the results of the project's multi-tiered Verification and Validation (V&V) Plan.

(4) Resolve all test, analysis, and inspection discrepancies.

(5) Integrate payload/launch vehicle and test.

(6) Prepare "as-built" and "as-deployed" hardware and software documentation, including "close-out" photographs.

(7) Complete all operational support and other enabling developments (e.g., facilities, equipment, and updated databases), including a*baseline* Operations Handbook to support the operations team.

(8) Conduct operational tests and training, including normal and anomalous scenarios.

(9) Prior to the project independent life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(10) Plan, prepare for, and support the project independent life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(11) Establish and maintain an integrated logistics support (ILS) capability, including spares, ground support equipment, and system maintenance and operating procedures, in accordance with the project's Logistics Plan.

(12) Forty-five (45) days prior to delivery of the spacecraft to the launch facility, update the Missile System Pre-Launch Safety Package (MSPSP) in accordance with NASA-STD-8719.8,*Expendable Launch Vehicle Payload Safety Review Process Standard*, June 1998, and Air Force Space Command Manual 91-710, *Range Safety User Requirements*, Vol. 3. (Note: The latest release is dated July 1, 2004.)

(13) Launch and perform system checkout. (Note: The checkout period is specified in the Project Plan.)

b. Perform project planning, costing, and scheduling activities-

(1) Implement Earned Value Management (EVM) as documented in the Project Plan.

(2) For contracts requiring EVM (see Appendix F, paragraph 3.1.c(6)), conduct required Integrated Baseline Reviews (IBRs).

(3) Prepare and finalize work agreements for Phase E.

c. Implement project cost and schedule control activities-

(1) Provide immediate written notice and a recovery plan to the Program Manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15% or more the KDP C-approved Integrated Baseline cost for Phases C through D. (Note: Since the Integrated Baseline cost contains project reserves, an EAC exceeding the Integrated Baseline cost presumes that these reserves will be exhausted.)

(2) Provide immediate written notice and a recovery plan to the Program Manager and the MDAA if a milestone listed for Phases C and D on the project life-cycle chart (Figure 2-4) is estimated to be delayed in excess of six months from the date scheduled in the KDP C-approved Integrated Baseline.

(3) If the trigger points in (1) or (2) above are breached and upon written notice from the Program Manager, update the Project Plan per direction received from the Program Manager.

d. Conduct KDP readiness activities-

(1) Obtain approved launch approval documents.

(2) Obtain KDP readiness products as shown in Table 4-3.

(3) Plan, prepare for, and support the governing PMC review prior to KDP E.

4.8 Projects - Phase E

4.8.1 **Purpose:** During Phase E, the project implements the Missions Operations Plan developed in previous phases. This phase culminates in KDP F. A summary of the required gate products for this phase is provided in Table 4-3.

4.8.2 **Requirements:** During Phase E, the Project Manager and the project team shall:

a. Perform technical activities-

(1) Implement the Project Plan.

(2) Execute the mission in accordance with the Mission Operations Plan and document this work in a Mission Report.

(3) Prior to the project life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(4) Plan, prepare for, and support the project life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(5) Monitor system incidents, problems, and anomalies, as well as system margins to ensure that deployed project systems function as intended, and investigate system behavior that is observed to exceed established operational boundaries or expected trends, and implement corrective actions, as necessary.

(6) Provide sustaining engineering, as appropriate, to the mission to enhance efficiency, safety, and accommodate obsolescence.

(7) Capture and archive mission results, including engineering data on system and subsystem performance, in an MDAA-approved data depository.

b. Perform project planning, costing, and scheduling activities-

(1) For Category 1 and 2 projects, update the CADRe consistent with the NASA Cost Estimating Handbook within 180 days after launch.

(2) As directed by the Program Manager, support the development of Project Plan revisions to continue the mission into extended operations beyond the primary mission phase or beyond any extension previously included in the plan.

(3) Prepare and document a *baseline* Systems Decommissioning/Disposal Plan.

(4) Prepare or update work agreements for Phase F.

c. Conduct KDP readiness activities-

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP F.

4.9 Projects - Phase F

4.9.1 **Purpose:**; During Phase F, the project implements the Systems Decommissioning/ Disposal Plan developed in Phase E, and performs analyses of the returned data and any returned samples.

4.9.2 **Requirements:** During Phase F, the Project Manager and the project team shall:

a. Perform technical activities-

(1) Complete analysis and archiving of mission and science data and curation of any returned samples, as well as archiving of project engineering and technical management data and documentation, and lessons learned in accordance with agreements, the Project Plan and Program Plan, and Center and Agency policies.

(2) Prior to the project life-cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(3) Plan, prepare for, and support the project life-cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(4) Implement the Systems Decommissioning/Disposal Plan and safely dispose of project systems.

b. For Category 1 and 2 projects, prepare a final CADRe consistent with the NASA Cost Estimating Handbook.

Products	Pre-Phase A	Phase A§	Phase B	Phase C	Phase D	Phase E
	KDP A	KDP B	KDP C	KDP D	KDP E	KDP F
Headquarters and Program Products						
1. FAD	Approved					
2. Program Requirements on the Project (from the Program Plan)	Draft	Baseline	Update			
3. ASM minutes		Baseline				
4. NEPA compliance documentation			Environmental Assessment or Environmental Impact Statement (if required)*			
5. Interagency & International Agreements			Baseline			
Project Technical Products						
1. Mission Concept Report	Preliminary	Baseline				
2. System Level Requirements		Preliminary	Baseline			
3. Preliminary Design Report			Baseline			
4. Missions Operations Concept		Preliminary	Baseline			
5. Technology Readiness Assessment Report			Baseline			
6. Missile System Pre-Launch Safety Package			Preliminary	Baseline	Update	
7. Detailed Design Report				Baseline		
8. As-built Hardware and Software Documentation					Baseline	
9. Verification and Validation Report					Baseline	
10. Operations Handbook				Preliminary	Baseline	
11. Orbital Debris Assessment		Initial	Preliminary	Baseline		
12. Mission Report						Final
Project Planning, Cost, and Schedule Products						
1. Work Agreements for next phase		Baseline**	Baseline	Baseline	Baseline	Baseline
2. Integrated Baseline	Draft	Preliminary	Baseline			
3. Project Plan		Preliminary	Baseline			
4. CADRe		Preliminary	Baseline	Update		Update
5. Planetary Protection Plan		Planetary Protection Certification	Baseline			
6. Nuclear Safety Launch Approval Plan		Baseline (mission has nuclear materials)				
7. Business Case Analysis for Infrastructure		Preliminary	Baseline			
8. Range Safety Risk Management Plan			Preliminary	Baseline		
9. Systems Decommissioning/Disposal Plan				Preliminary		Baseline
KDP Readiness Products						
1. Standing Review Board Report (SRB)	Final	Final	Final	Final	Final	Final
2. Project Manager Recommendation (includes response to SRB Report, as applicable)	Final	Final	Final	Final	Final	Final
3. CMC Recommendation	Final	Final	Final	Final	Final	Final
4. Program Manager Recommendation	Final	Final	Final	Final	Final	Final
5. MD-PMC Recommendation (for Category I projects only)	Final	Final	Final	Final	Final	Final
6. Governing PMC Recommendation	Final	Final	Final	Final	Final	Final

* See Section 4.5.2 a. (2) for exceptions.

§ See footnote 15 in Section 4.4 for competed mission exceptions

** Phase A work agreements are prepared and finalized as early as practical in Phase A.

Table 4-3 Project Gate Products Maturity Matrix

NPR 7120.5D Project Plan - Control Plans	Pre-Phase A	Phase A	Phase B	Phase C	Phase D	Phase E
	KDP A	KDP B	KDP C	KDP D	KDP E	KDP F
1. Technical, Schedule, and Cost Control Plan		Preliminary	Baseline			
2. Safety and Mission Assurance Plan		Preliminary	Baseline			
3. Risk Management Plan		Preliminary	Baseline			
4. Acquistion Plan		Preliminary	Baseline			
5. Technology Development Plan		Baseline				
6. Systems Engineering Management Plan		Baseline				
7. Software Management Plan		Preliminary	Baseline			
8. Review Plan		Preliminary	Baseline			
9. Missions Operations Plan			Preliminary	Baseline		
10. Environmental Management Plan		Baseline				
11. Logistics Plan		Preliminary		Baseline		
12. Science Data Management Plan			Preliminary	Baseline		
13. Information and Configuration Management Plan		Preliminary	Baseline			
14. Security Plan		Preliminary	Baseline			
15. Export Control Plan		Preliminary	Baseline			

Table 4-4 Project Plan Control Plan Maturity Matrix

| TOC | Preface | Chapter1 | Chapter2 | Chapter3 | Chapter4 | AppendixA | AppendixB | AppendixC | AppendixD | AppendixE | AppendixF | AppendixG | AppendixH | AppendixI | Figure2-2 | ALL |

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